Livestock and Environmental Variables to Identify Possible Vulnerabilities for Rift Valley Fever along the Tanya River, Kenya

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Objective:

Annually Rift Valley Fever, a phlebovirus from the family of Bunyaviridae, causes billions of economic damages and loss of productive human days through illness and death in Africa. Humans exhibit flu-like symptoms such as chills and fever or may persist to hemorrhagic fever. In pastoral animals, spontaneous abortions or death occurs, especially in sheep and cattle (Linthicum, and Peters 125). This impact alone advises further investigation of this disease, but an increase in episodic outbreaks since the introduction of Rift Valley Fever in Kenya in 1972 warrants a comprehensive look on disease amplification variables in this already vulnerable region (Murith, et al., 139). Geographic informational System was the chosen technology to aid in this investigation because of its ability to present and analyze multiple disease and ecological factors. The chosen disease variables in this study include: human population, livestock herds, and flooding plains of oxbow along the Tanya River.

Disease Background

The known vectors of Rift Valley Fever are species within the Culex and Aedes families of freshwater mosquitoes. After rainy seasons in Kenya, mosquitoes lay their eggs in the flood plains or pond that were created. After maturation, vectors choose to feeding on pastoral animals, especially cattle and sheep, which acts as an amplification host (Linthicum, and Peters 125). An amplification host serves as a place where a virus can replicate. Pastoral animals tend to graze near water sources and humans tend to settle within distance to water sources, which causes a dependency on water sources. The relationship between these variables creates an optimum situation for outbreaks.

Study Site

Due to population growth, size of freshwater source, and source breeding habitat, the study area of choice is along the Tanya River (Kenya) which runs 1500 km from the Aberdare range and drains in the Indian Ocean (‘Kenya National Water Development Report’ 46). Seasonal flooding along the Tanya River creates flooding zones along oxbows, and ponds that are fertile grounds for mosquito oviposition and hatching of eggs (Tourre, et al, 70). This poses an increase in possible transmission because of the past system around Tanya River. The land surrounding the Tanya River’s flood plains is categorized as semi and which means animals are classified at pastoral. Pastoral animals graze over large areas of land in search of food and water, which increases the chance of transmission if animal is virulent (Otte 17; Zaal).

Results

Map 4: Overlay of highest density livestock and their buffer zones were compared against the population density. Near the town of Garissa and to the northwest have the greatest correlation between high livestock and population density.

Map 5: Proximity analysis of oxbows was performed to created multiple rings buffers and compared to livestock over 20 density per kilometer square. Overlap and highest proximity areas are located in the northwest and by the town of Garissa.

Discussion

Analysis of maps with multiple variables: oxbow buffers, livestock density and grazing buffers, floodplains, and population’s densities shows there are three vulnerable regions within the Tanya River and Garissa Districts. The northwest portion of the map and near the town of Garissa shows vulnerable regions due to high the population and livestock density as well as the livestock’s close proximity to the oxbow buffers. The high density of livestock near the floodplain poses a risk of substantial amplification after heavy rainfall. Also, if livestock are brought to the town of Garissa for trading and buy purposes a risk of transmission could be exposed to the urban population.

Study Limitations:

• Inconsistent and inaccurate sampling of data collection
• Livestock data did not contain subgroups specifically for sheep and cattle
• Outdated population data; no updated data since 1999
• Data could not be statistically analyzed easily because of parameters how the attribute table was set up

Conclusions:

Instead of focusing on limitations within the data, improvement of collection and dissemination of transmission variables of Rift Valley Fever would greatly improve identification of vulnerable districts. This would allow for implementation of serosurveillance programs and potential vaccines sites to prevent in outbreaks. Further resources and efforts should be invested into obtaining and analyzing transmission variables for Rift Valley Fever along the Tanya River.

References:


